

WHITE PAPER

From Positive Displacement to SMART Meter™:

The Heart of the Most Accurate Dispenser in the World

Background: Fuel Metering as it Has Been.

The technology for metering retail motor fuels matured in the 1970s and has changed very little since then. While there are many ways to measure retail fuel, the current industry standard is positive displacement metering.

Positive displacement metering is based on a simple process: the meter fills an internal chamber of known dimensions with fuel, then delivers that known amount through the dispenser. The meter calculates the total volume dispensed by essentially multiplying the known capacity of the chamber by the number of times it delivers the chamber's quantity of fuel through the dispenser.

Even after years of refinement and improvement, positive displacement technology has probably reached the limits of its capability because of a number of inherent factors that adversely affect the accuracy of the measurement performed by the meter. In fact, after a 1970s study of the limitations of positive displacement measurement of fuel, the National Institute of Standards and Technology (NIST) issued standards to establish the allowable amount of error when measuring fuel. NIST set a standard of plus or minus 0.5 percent (plus or minus 6 cubic inches) on a five gallon delivery. This standard has been adopted throughout the U.S. as the regulatory standard enforced by state agencies responsible for Weights and Measures.

Fuel Meters of the Future.

SMART Meter™ technology is fundamentally different from positive displacement meters. Instead of using a continuous cycle of filling and emptying an internal chamber, SMART Meter measures fuel volume with inferential flow-through technology that collects flow data from spinning turbines. Additionally, through the use of advanced algorithms, the SMART Meter is able to sense and react to changes in fuel temperature and viscosity to increase accuracy and adapt to changing fuel conditions.

Advantages of the New Technology.

SMART Meter™ technology results in greatly improved meter performance because its design addresses the most prominent factors that diminish the accuracy of positive displacement meters.

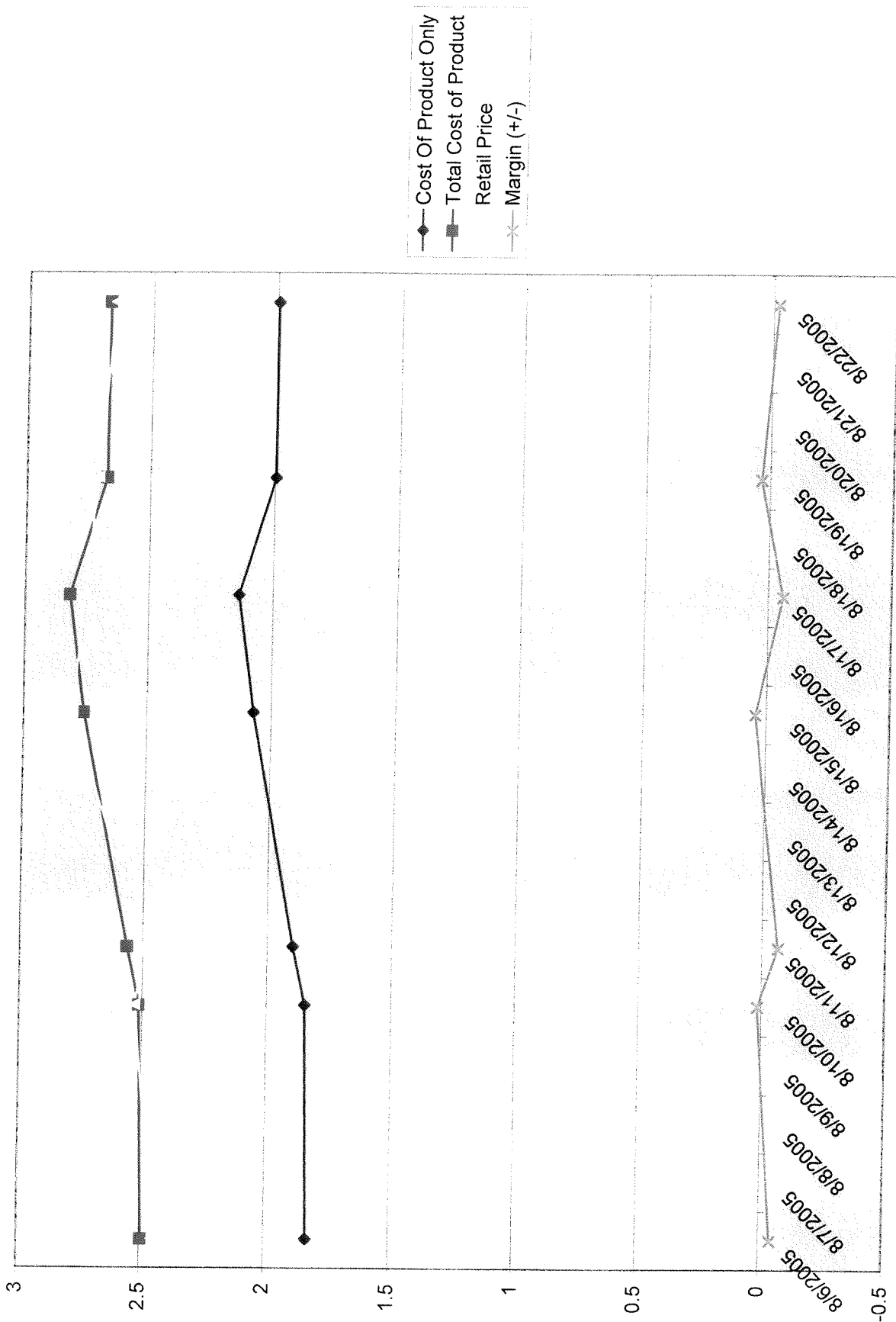
Meter Drift Due to Wear. Positive displacement meters usually use pistons to fill and empty the pre-measured chamber inside the meter. This means there is friction between the piston and the chamber wall throughout each dispensing operation, which eventually results in wear to both surfaces. This wear alters the size of the chamber, causing measurement errors in fuel dispensing. This is one of the most significant causes of meter drift (a permanent bias away from accurate measurement by a meter) on a positive displacement system.

Because the wear inherent to positive displacement meters enlarges the chamber in the meter, meter drift usually causes the unit to deliver a greater quantity of fuel than the intended pre-measured volume the meter was designed to send through the fuel dispenser. The resulting "fuel give-away" results in an estimated \$200 million in fuel losses to the U.S. retail fuel industry each year.

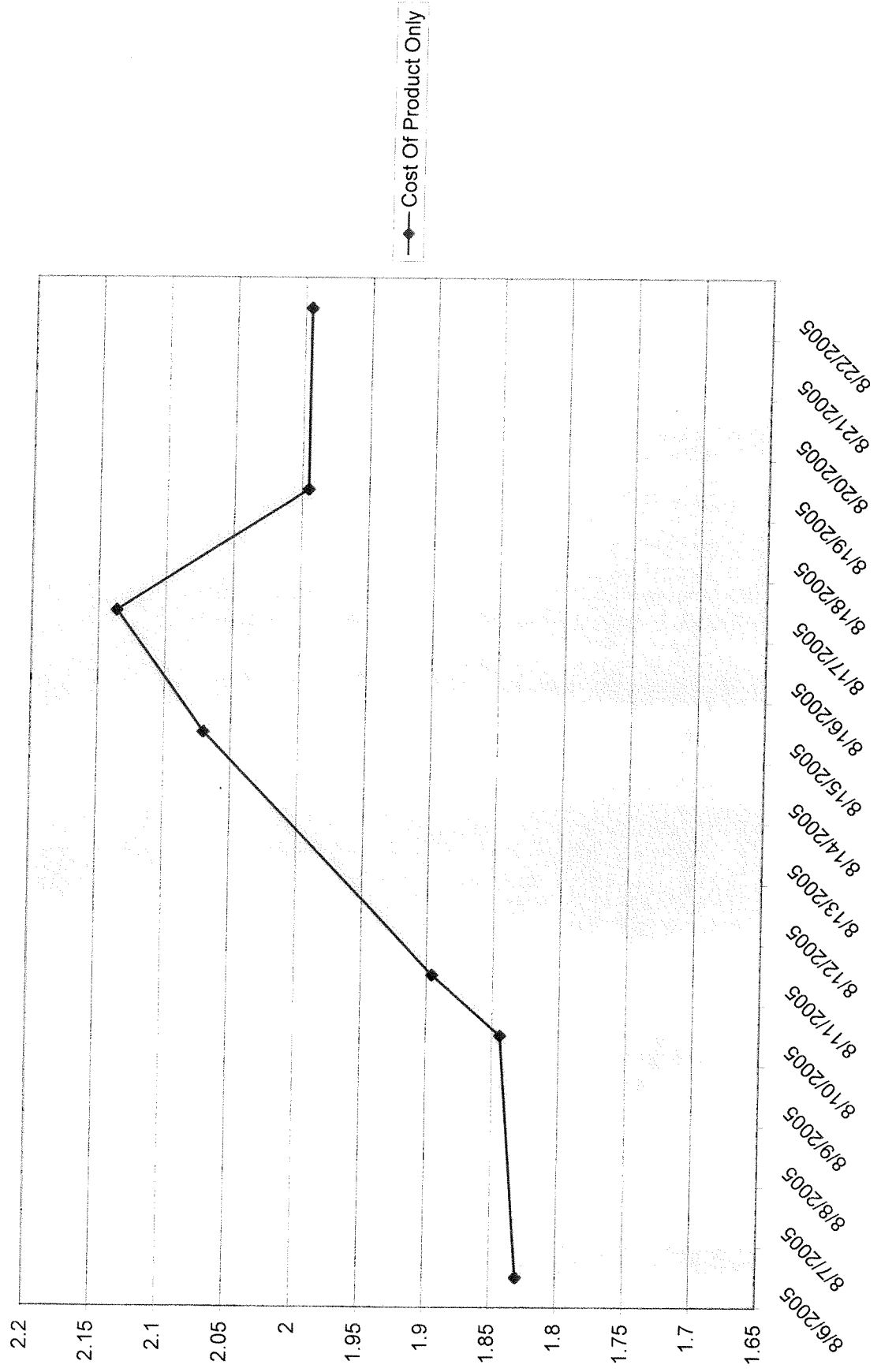
The SMART Meter is designed so there are no wear points. The rotating turbine blades used in SMART Meter's inferential flow fluid measurement system do not come into contact with other moving parts, minimizing wear in the meter. This makes SMART Meter immune to drift due to wear.

	1-Aug-03	17-Aug-05	Percent Increase
Product Only	0.9684	2.136	120.57%
Freight	0.02	0.02	
Fed Motor Fuel Tax	0.184	0.184	
State Motor Fuel Tax	0.19	0.19	
Michigan UST Fee	0.00875	0.00875	
Subtotal	1.37115	2.53875	85.15%
Michigan Sales Tax	0.070132	0.145416	107.34%
Subtotal	\$1.441	\$2.684	86.23%
Cost of Business	0.1334	0.1334	
Total Cost of Product	\$1.575	\$2.818	78.93%
Retail	\$1.429	\$2.759	93.07%
Margin (+/-)	-\$0.146	-\$0.059	

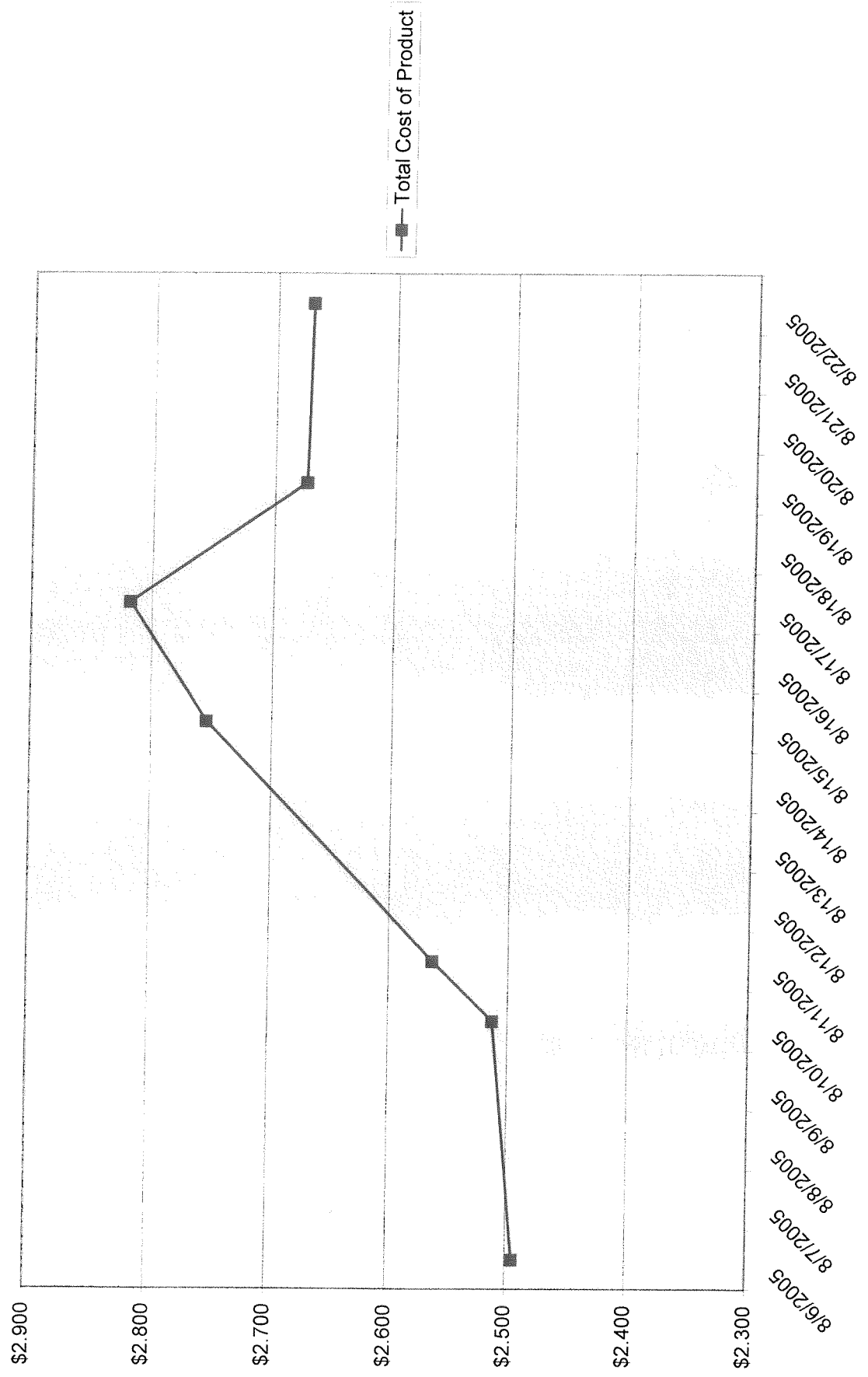
6-Aug-05	10-Aug-05	11-Aug-05	15-Aug-05	17-Aug-05	19-Aug-05	22-Aug-05	
1.83	1.844	1.896	2.07	2.136	1.995	1.995	Product Only
0.02	0.02	0.02	0.02	0.02	0.02	0.02	Freight
0.184	0.184	0.184	0.184	0.184	0.184	0.184	Fed Motor Fuel Tax
0.19	0.19	0.19	0.19	0.19	0.19	0.19	State Motor Fuel Tax
0.00875	0.00875	0.00875	0.00875	0.00875	0.00875	0.00875	Michigan UST Fee
2.23275	2.24675	2.29875	2.47275	2.53875	2.39775	2.39775	Subtotal
0.127925	0.132397	0.130699	0.14768	0.145416	0.142585	0.139189	Michigan Sales Tax
\$2.361	\$2.379	\$2.429	\$2.620	\$2.684	\$2.540	\$2.537	Subtotal
0.1334	0.1334	0.1334	0.1334	0.1334	0.1334	0.1334	Cost of Business
\$2.494	\$2.513	\$2.563	\$2.754	\$2.818	\$2.674	\$2.670	Total Cost of Product
\$2.450	\$2.529	\$2.499	\$2.799	\$2.759	\$2.709	\$2.649	Retail
-\$0.044	\$0.016	-\$0.064	\$0.045	-\$0.059	\$0.035	-\$0.021	Margin (+/-)



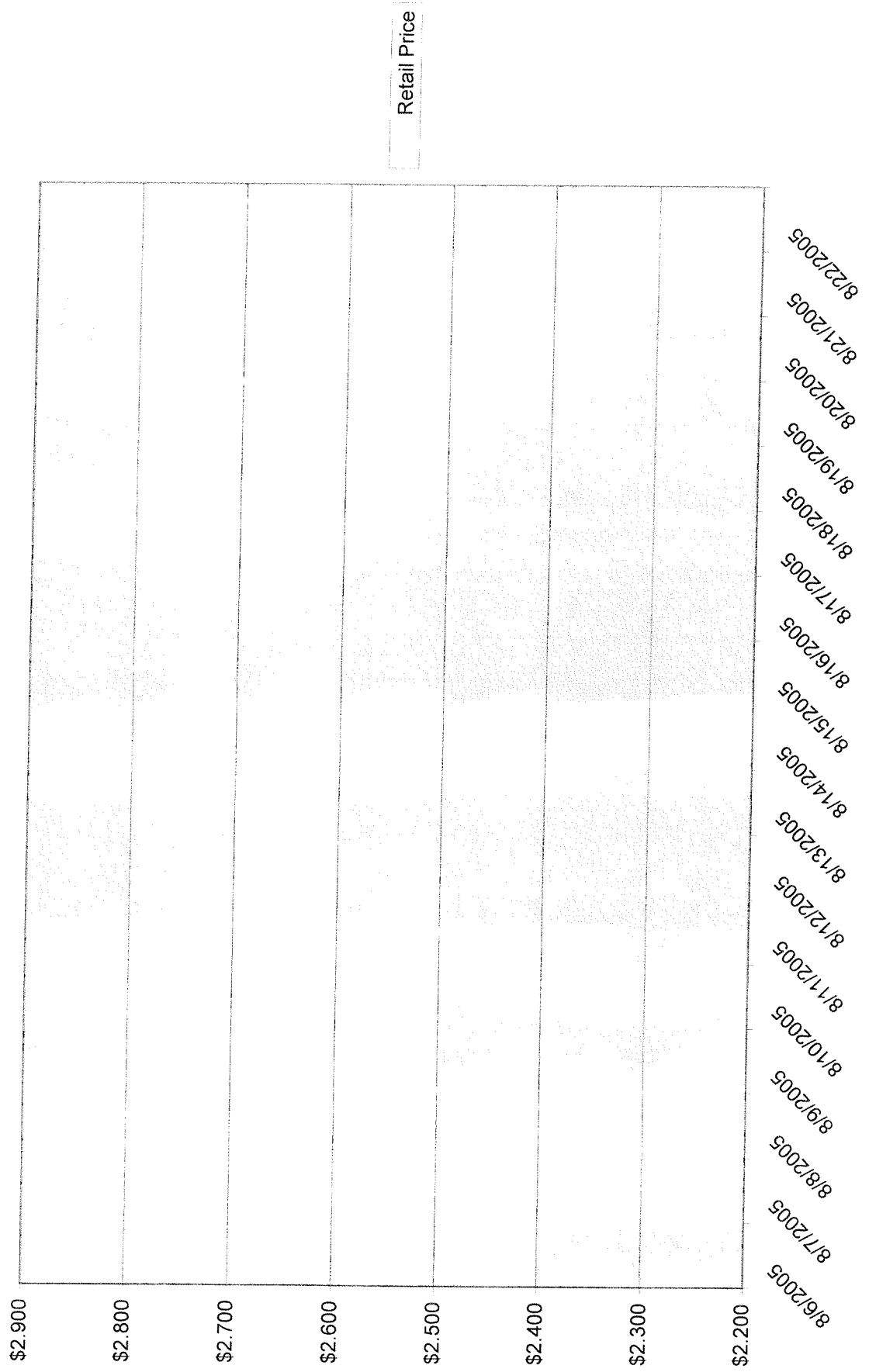
Cost Of Product Only



Total Cost of Product

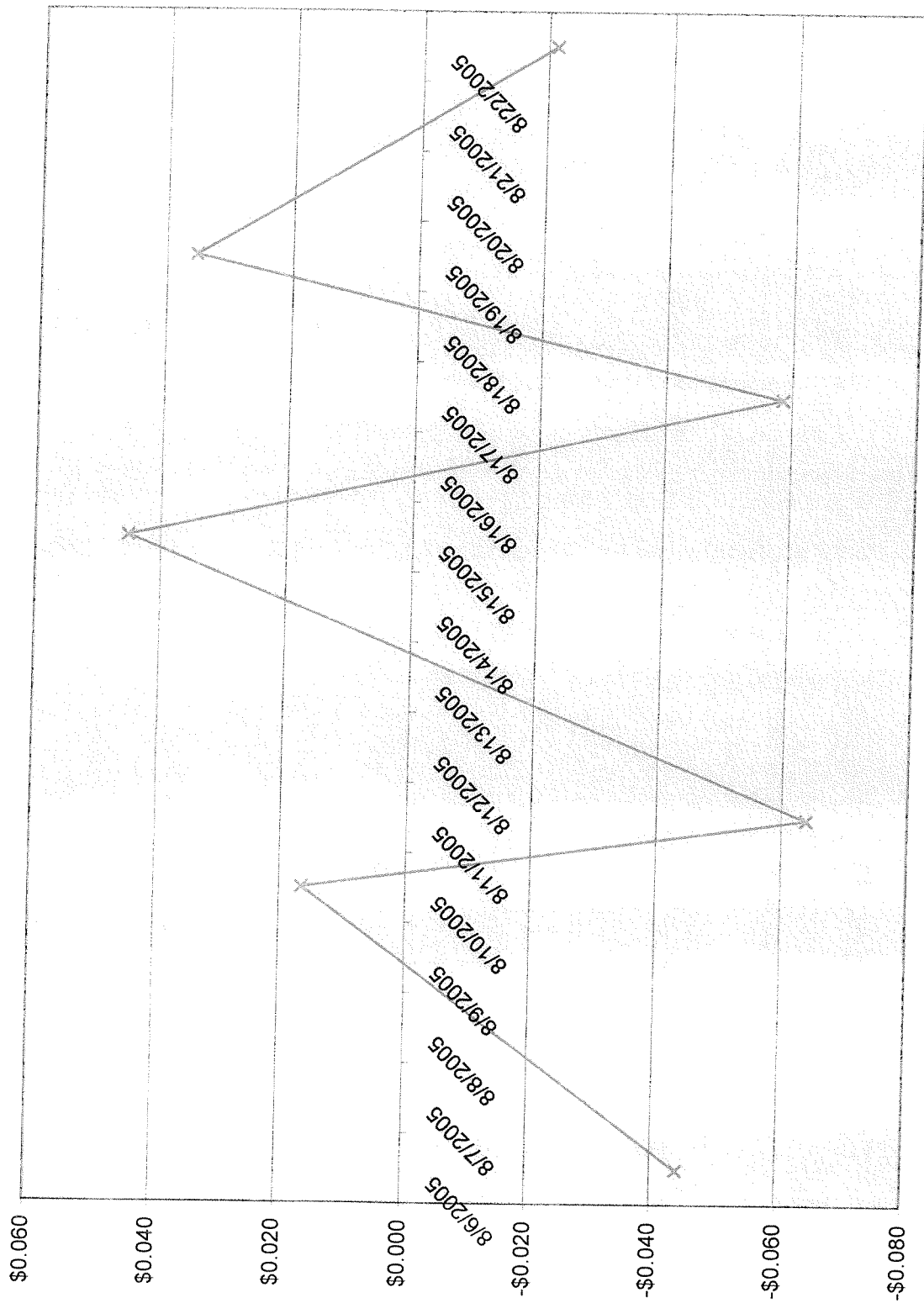


Retail Price



Retail Price

Margin (+/-)



Margin (+/-)